Soft-Shell Clam Resource Survey of Three Fathom Harbour and Clam Harbour, Nova Scotia—1985

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by

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ABSTRACT

Mullen, B. and P. Woo. 1985. Soft-shell clam resource survey of Three Fathom Harbour and Clam Harbour, Nova Scotia - 1985. Can. MS Rep. Fish. Aquat. Sci. 1877: iv + 39 p.

Assessments of soft-shell clam (Mya arenaria) stocks were carried out in two "open" shellfish-producing areas in Halifax County, Nova Scotia: Three Fathom Harbour and Clam Harbour. The standing stock of pre-recruits (43-50 mm in shell length) ranged from 4.2 to 50.9 bu/ha. The standing stock of recruits (≥51 mm shell length) ranged from 29.6 to 71.3 bu/ha. In this region, Statistical District 20, landings have esculated from 1 t in 1978 to peak at 241 t in 1982. Standing stocks were determined to be higher in these areas than other areas of Nova Scotia previously surveyed. Three Fathom Harbour and Clam Harbour appear to be able to support higher levels of fishing than they are presently experiencing.

RÉSUMÉ

Mullen, B. and P. Woo. 1985. Soft-shell clam resource survey of Three Fathom Harbour and Clam Harbour, Nova Scotia - 1985. Can. MS Rep. Fish. Aquat. Sci. 1877: iv + 39 p.

On a procédé à des évaluations des stocks de myes communes (Mya arenaria) dans deux secteurs de production de coquillages "ouverts" du comté d'Halifax, soit à Fathom Harbour et à Clam Harbour. La biomasse actuelle de pré-recrues (coquille mesurant de 43 à 50 mm de longueur) varie de 4,2 à 50,9 boisseaux/hectare. La biomasse actuelle de recrues (longueur de coquille ≥51 mm) varie de 29,6 à 71,3 boisseaux/hectare. Dans cette région, soit le district statistique n°20, les débarquements ont grimpé de 1 tonne en 1978 à un sommet de 241 tonnes en 1982. On constate que la biomasse de myes communes est plus élevée dans ces secteurs que dans les autres secteurs déjà examinés en Nouvelle-Ecosse. Il semble que les secteurs de récolte de Three Fathom Harbour et de Clam Harbour pourraient sontenir un effort de pêche accru.

INTRODUCTION

Three Fathom Harbour and Clam Harbour are located on the northeastern shore of Nova Scotia in Statistical District 20 (Fig. 1). Landed values have been significantly increasing since 1978. These areas are frequently used by numerous clam diggers and tourists who dig clams for their personal consumption. Historically these two clam flats have supported a number of full-time clam fishermen in the area (Table 1). The harvesting season begins in late February and continues until early fall. Clam harvests by full-time fishermen in Three Fathom Harbour range from 40-50 kg of whole animal weights each tide early in the season to 15-26 kg each tide as the season progresses.

MATERIALS AND METHODS

Three Fathom Harbour consists of 11.0 ha of surveyed clam flat, of which 7.26 ha were sampled. The remaining 3.74 ha were inaccessable due to soft mud or mud covered with eelgrass. The surveyed area of Clam Harbour consists of 13.68 ha which were divided into Areas 1 and 2 (Table 2; Fig. 2).

POPULATION SURVEY

Samples in Three Fathom Harbour were collected at 226 stations along 34 transects, the total sampled area being 7.26 ha (Fig. 3). Substrate in the sampled area ranged from sand and small amounts of mud to progressively muddier and less sandy substrate types. Samples taken at Clam Harbour Area 1 (Fig. 2) were collected at 185 stations along 22 transects, the total sampled area being 6.52 ha.

In Area 2 (Fig. 2) samples were collected at 201 stations along 22 transects, the total sampled area being 7.16 ha.

The substrate in Clam Harbour was predominantly sandy, with very small amounts of mud being found along the northwestern end of the transects in Area 2. The standing stock of soft-shell clams was expressed in bushel per hectare (Angus et al. 1985a) and kilograms per hectare (Hawkins and Rowell 1984) for each recruitment category.

In each area samples were collected at 20 m intervals along parallel transects, 20 m apart aligned perpendicular to a baseline positioned along the shore at the first occurrence of live clams (Figs. 2 and 3). The transects continued seaward until the mean low tide level or very soft mud was reached. A sampling intensity of 0.025% was achieved.

The sampling strategy was similar to that previously described in Angus et al. 1985a and b. The only deviation was the washing of the whole sample in the field through a 2 mm wire mesh screening. Samples were then labelled and returned to the laboratory. The samples were stored frozen until the clams could be removed and their lengths determined to the nearest millimeter

by measurement along the longest axis. The animals were arranged into three recruitment categories: early recruits, 0-42 mm; pre-recruits, 43-50 mm; and recruits, ≥51 mm shell length. The percentage of each recruitment category was obtained from the frequency distributions and recorded (Table 3). The density of clams in each of the size categories was calculated and plotted with density isopleths highlighting areas of soft-shell clam concentrations for each of the surveyed areas (Figs. 4 to 9).

AGING

A random sample of 100 clams was collected from each area. Each sample was shucked and the shells cleaned and dried. Each shell was singularly immersed in water and placed over a bright light to illuminate the growth rings. Each ring which represented an annual growth increment was highlighted using a pencil. Each highlighted growth increment was then measured from the umbo using Vernier calipers, to determine length at age. Length measurements were made to the nearest millimeter.

RESULTS

A von Bertalanffy growth equation of the form $L_t = L_\infty (1-e^{-k(t-t_o)})$ was fitted to length-at-age data and generated age/size classes for both Three Fathom Harbour and Clam Harbour, where:

L_t - length at time t (millimeter)
L_∞ - maximum length (millimeter)
e - (base natural log)
K - coefficient of catabolism
t - time (years)
t_o - time at which clam had zero length

The von Bertalanffy parameters for Three Fathom Harbour are L_∞ = 98.09, K = 0.11 and t_o = 0.081; and for Clam Harbour are L_∞ = 123.46, K = 0.088, and t_o = 0.221.

Upon fitting the above equation it was found that soft-shell clams in Clam Harbour reached market size (≥51 mm) in 6.2 yr (Table 4). In Three Fathom Harbour growth to market size required 6.7 yr (Table 5). The greatest standing stock of market-size recruits was found in Clam Harbour Area 1, with 1,943.8 kg/ha (Table 6). A size-frequency distribution was plotted using shell length intervals equivalent to age/size categories (Figs. 10 and 11).

The greatest percentage of soft-shell clams occupied the early recruit category, 0-42 mm, for both Clam Harbour and Three Fathom Harbour. The largest number of clams was found in Clam Harbour Area 1, with both pre-recruits and recruits in this area far surpassing the populations determined in both of the areas. The largest number of clams per square meter of early recruits was in Clam Harbour Area 2.

DISCUSSION

Clam Harbour has a greater number of market-size clams than Three Fathom Harbour (Table 7). The early-recruit category was dominant in Three Fathom Harbour suggesting that the population of market-size clams will rebound. Studies of clams from both areas have revealed slower growth in Three Fathom Harbour, which has been shown to be linked with environment (Spear and Glude 1957). In comparison with other areas of Nova Scotia the standing stock is higher in Clam Harbour and Three Fathom Harbour [Angus et al. 1985a; 1986 (in press); Witherspoon 1982; 1983] suggesting that these areas can support a greater fishing intensity without resource depletion.

ACKNOWLEDGEMENTS

We wish to thank B. Mason, C. Welch, D. Burton, and F. Pellerin for their help and participation in conducting this survey, also thanks to M.J. Tremblay and T. Amaratunga for reviewing the manuscript.

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Table 1. Soft-shell clam landings* (metric tons) - Statistical District 20.

Year	Landings
1978	1
1979	13
1980	2
1981	122
1982	241
1983	139
1984	119

*Statistics Division, Management Services Branch, Department of Fisheries and Oceans, Scotia-Fundy Region, Halifax, N.S. B3J 2S7.

Table 2. Areal coverage of survey areas - Halifax, N.S.

Location	Total area surveyed (ha)	Total area sampled (ha)
Three Fathom Harbour	11.0	7.26
Clam Harbour - Area 1	6.52	6.52
- Area 2	7.16	7.16

Table 3. Percentage of the surveyed population attributed to the three recruitment categories.

Location	Recruitment category		
	% early recruits (0-42 mm)	% pre-recruits (43-50+ mm)	% recruits (≥51 mm)
Three Fathom Harbour	97.21	0.50	2.27
Clam Harbour - Area 1	70.41	17.48	12.12
- Area 2	97.56	0.84	1.61

Table 4. Length-at-age data from the von Bertalanffy growth equation for Clam Harbour.

Age (yr)	Length[1] (mm)	Width[2] (mm)	Recruitment category
1	8.16	5.45	
2	17.90	10.39	Early recruits
3	26.82	14.98	0 - 42 mm
4	34.99	20.98	Age 1-4.9
5	42.46	26.25	
6	49.31	30.77	Pre-recruits 43-50 mm
7	55.58	34.29	Age 5.1 - 6.1
8	61.31	37.88	Recruits 51+ mm
9	66.56	40.00	Age 6.2+

[1]Predicted from the von Bertalanffy growth equation.

[2]Predicted from the von Bertalanffy growth equation.

Table 5. Length-at-age data from the von Bertalanffy growth equation for Three Fathom Harbour.

Age (yr)	Length[1] (mm)	Width[2] (mm)	Recruitment category
1	9.48	5.96	
2	18.76	10.74	Early recruits
3	27.07	15.10	0 - 42 mm
4	34.51	19.93	Age 1-5.2
5	41.17	24.38	
6	47.13	28.43	Pre-recruits 43-50 mm
7	52.47	32.12	Age 5.3 - 6.6
8	57.25	35.44	Recruits 51+ mm
9	61.52	34.00	Age 6.7+
10	65.35	38.00	
11	68.78	42.00	

[1]Predicted from the von Bertalanffy growth equation.

[2]Predicted from the von Bertalanffy growth equation.

Table 6. Standing stock of soft-shell clams expressed in bushels* and kilograms per hectare.

Recruitment category	Surveyed area					
	Three Fathom Harbour		Clam Harbour			
			Area 1		Area 2	
	bu/ha	kg/ha	bu/ha	kg/ha	bu/ha	kg/ha
Pre-recruits (43-50 mm)	4.20	114.60	50.89	1,397.1	9.07	247.53
Recruits (mm)						
(51-58)	15.87	433.15	40.50	1,105.1	15.03	410.28
(59-63)	11.19	305.49	18.06	493.04	6.74	183.96
(64-67)	7.52	205.29	6.60	179.01	2.41	65.91
(68-73)	7.78	212.39	3.81	103.9	4.38	119.56
(74+)	3.75	102.38	2.29	62.50	1.05	28.79
Total recruits:	46.11	1,258.7	71.26	1,943.85	29.61	808.50

*Based on 27.3 kg per bushel (Robert 1981).

Table 7. Density (number) of clams per square meter for each area.

Recruitment Category	Location		
	Three Fathom Harbour	Clam Harbour	
		Area 1	Area 2
Early recruits	213.50	54.00	220.55
Pre-recruits	1.11	13.41	2.39
Recruits	4.99	9.30	3.63

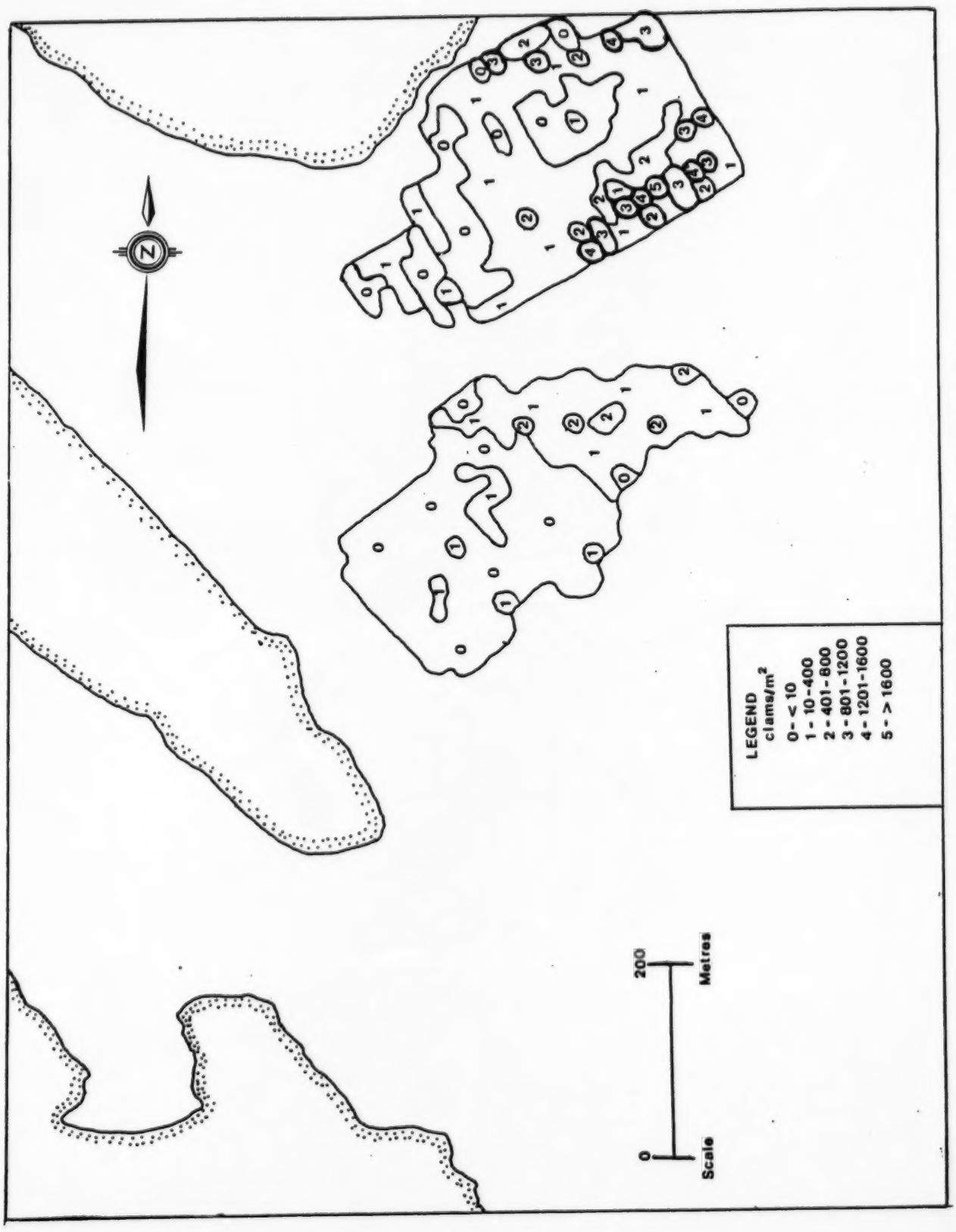

Fig. 7. Clam Harbour - isopleths of clam density and distribution - early recruits.

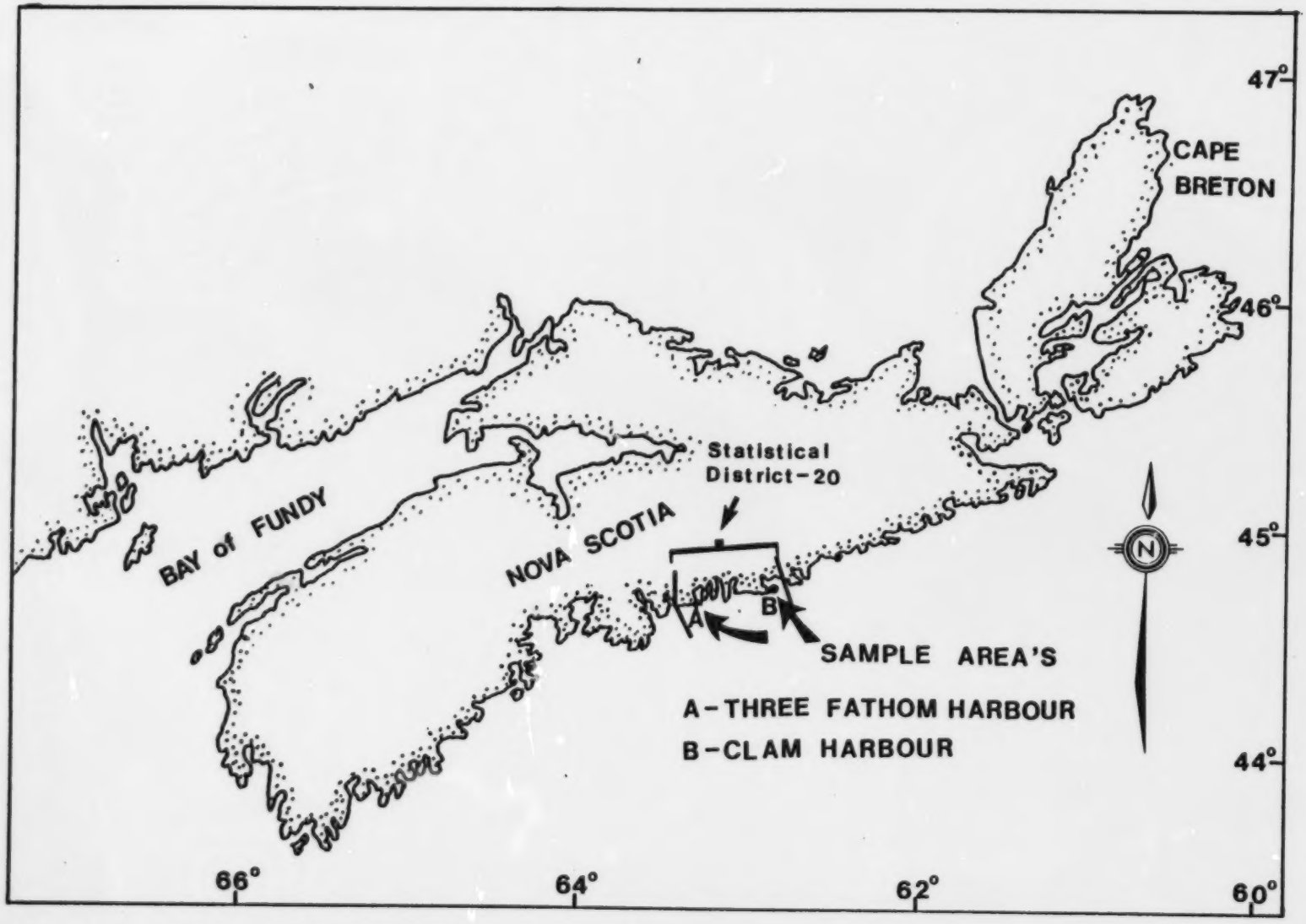

Fig. 1. Three Fathom Harbour and Clam Harbour sample areas.

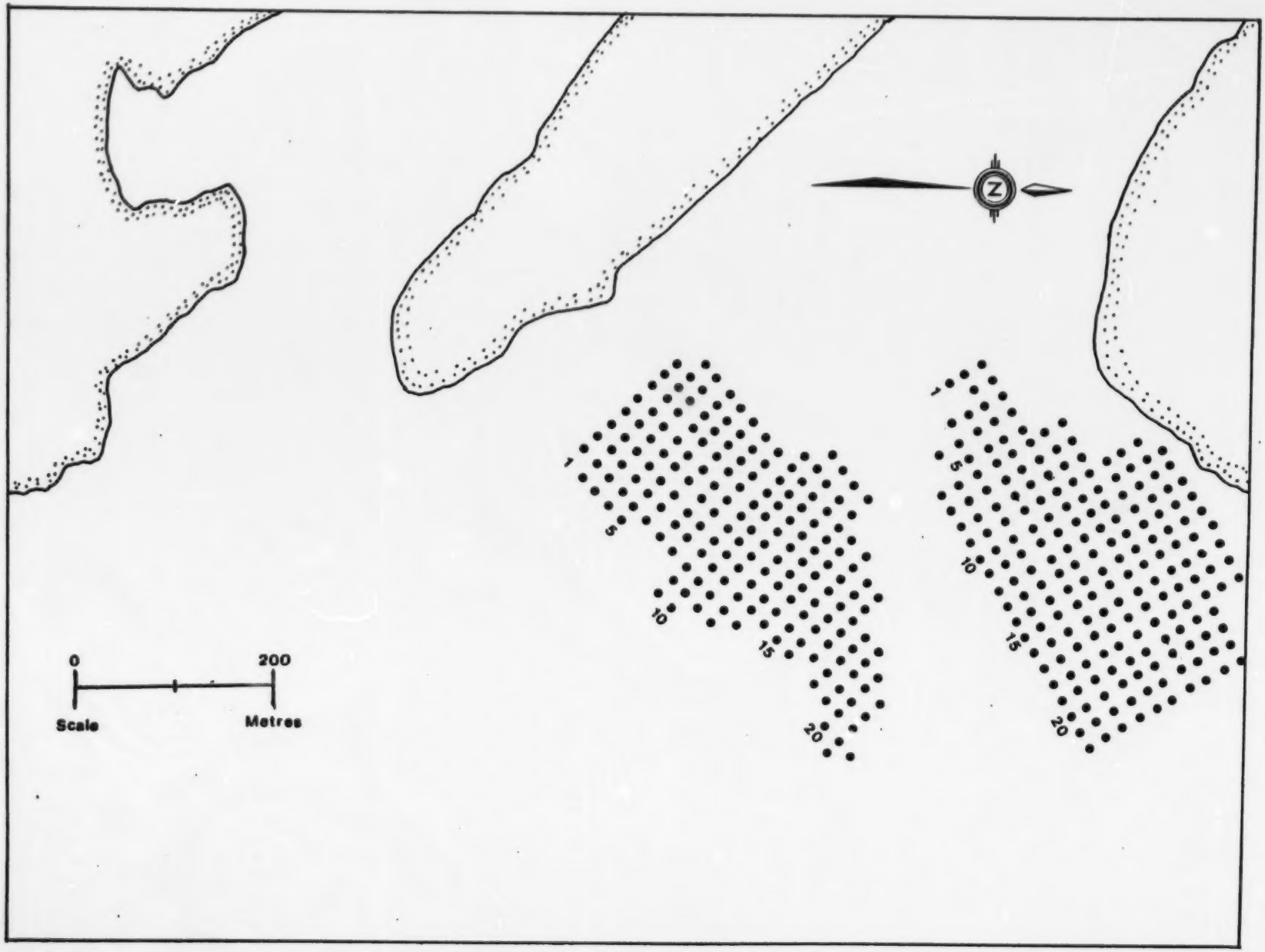

Fig. 2. Clam Harbour transects and stations.

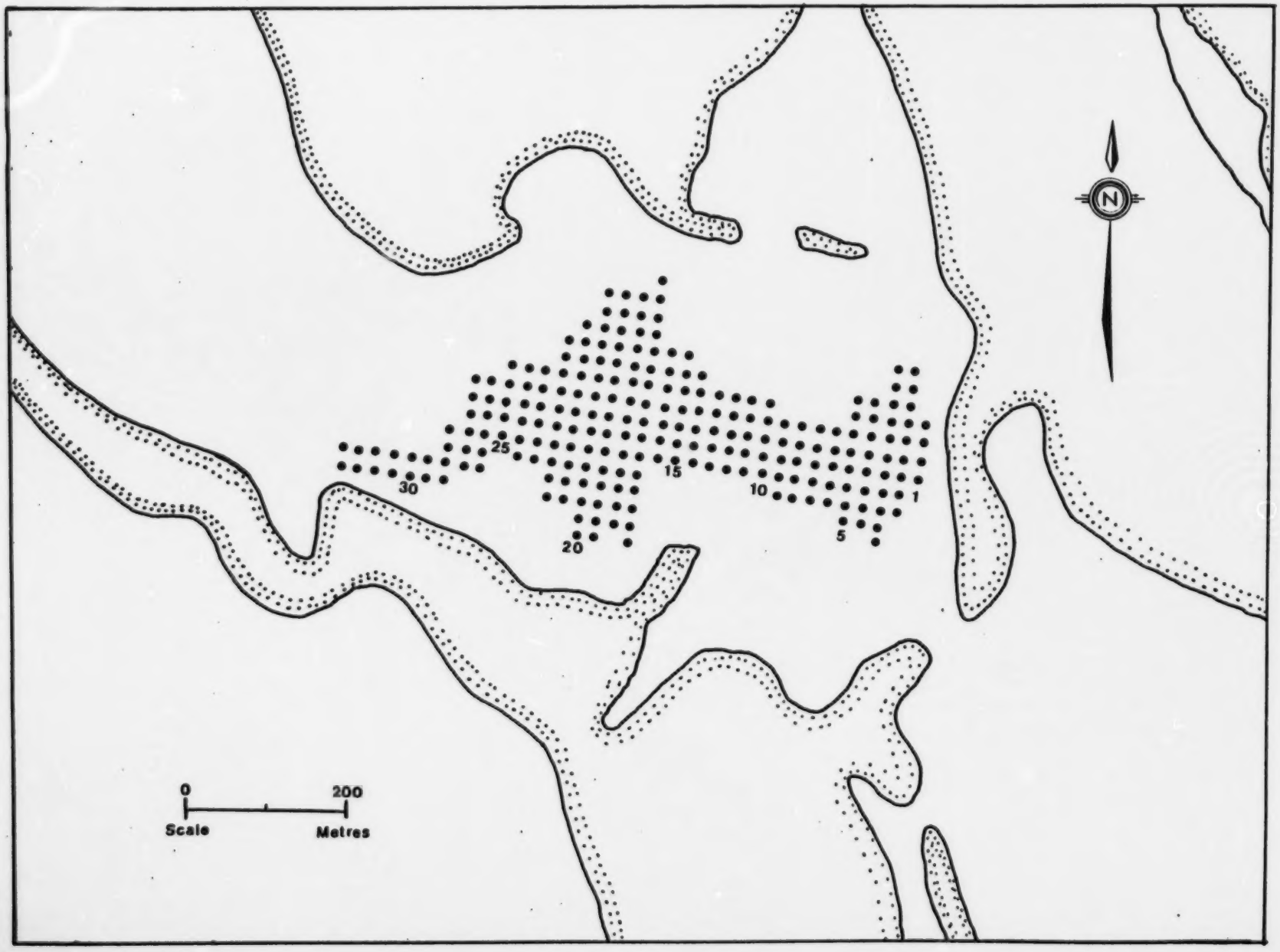

Fig. 3. Three Fathom Harbour transects and stations.

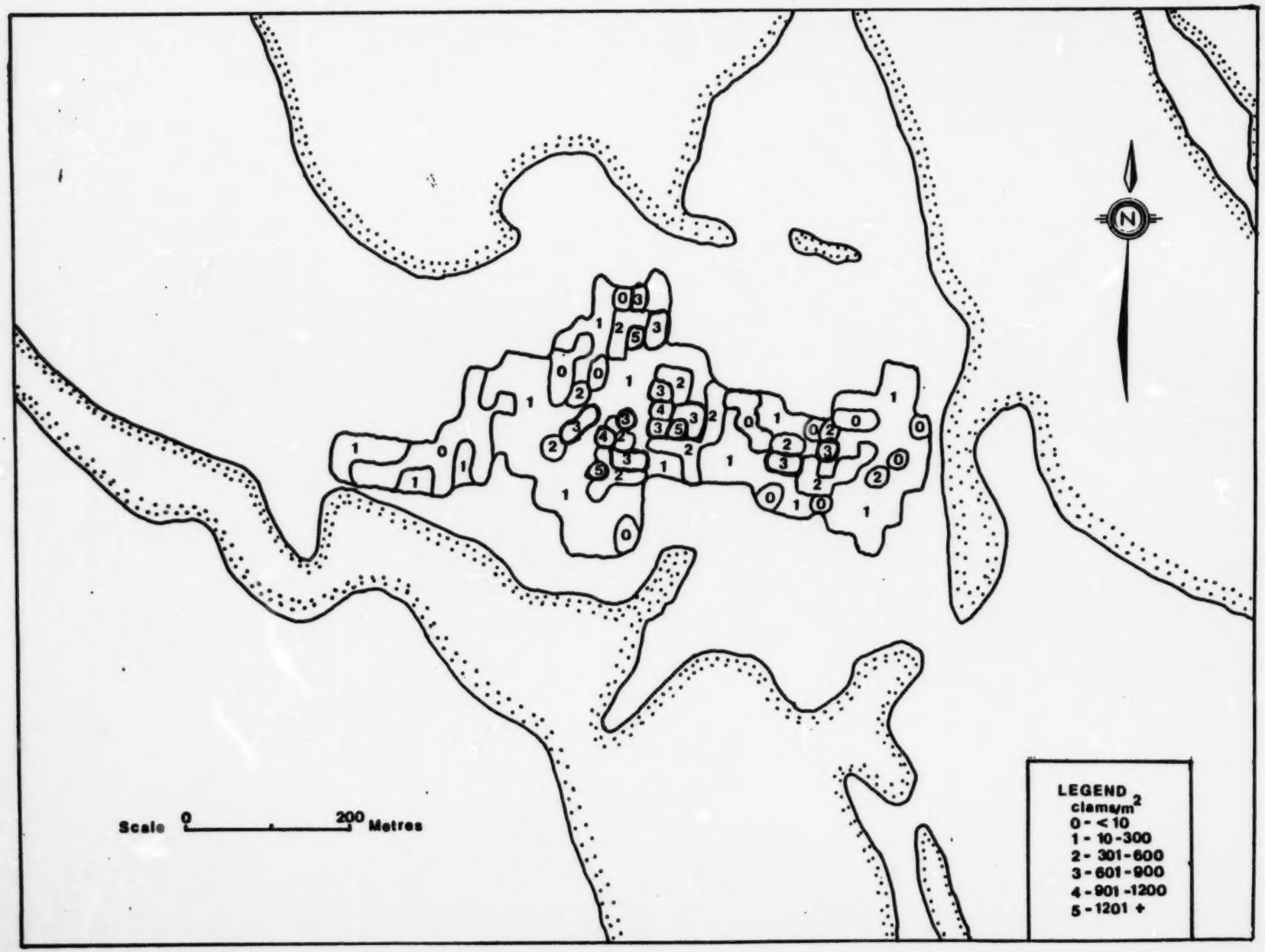

Fig. 4. Three Fathom Harbour - isopleths of clam density and distribution - early recruits.

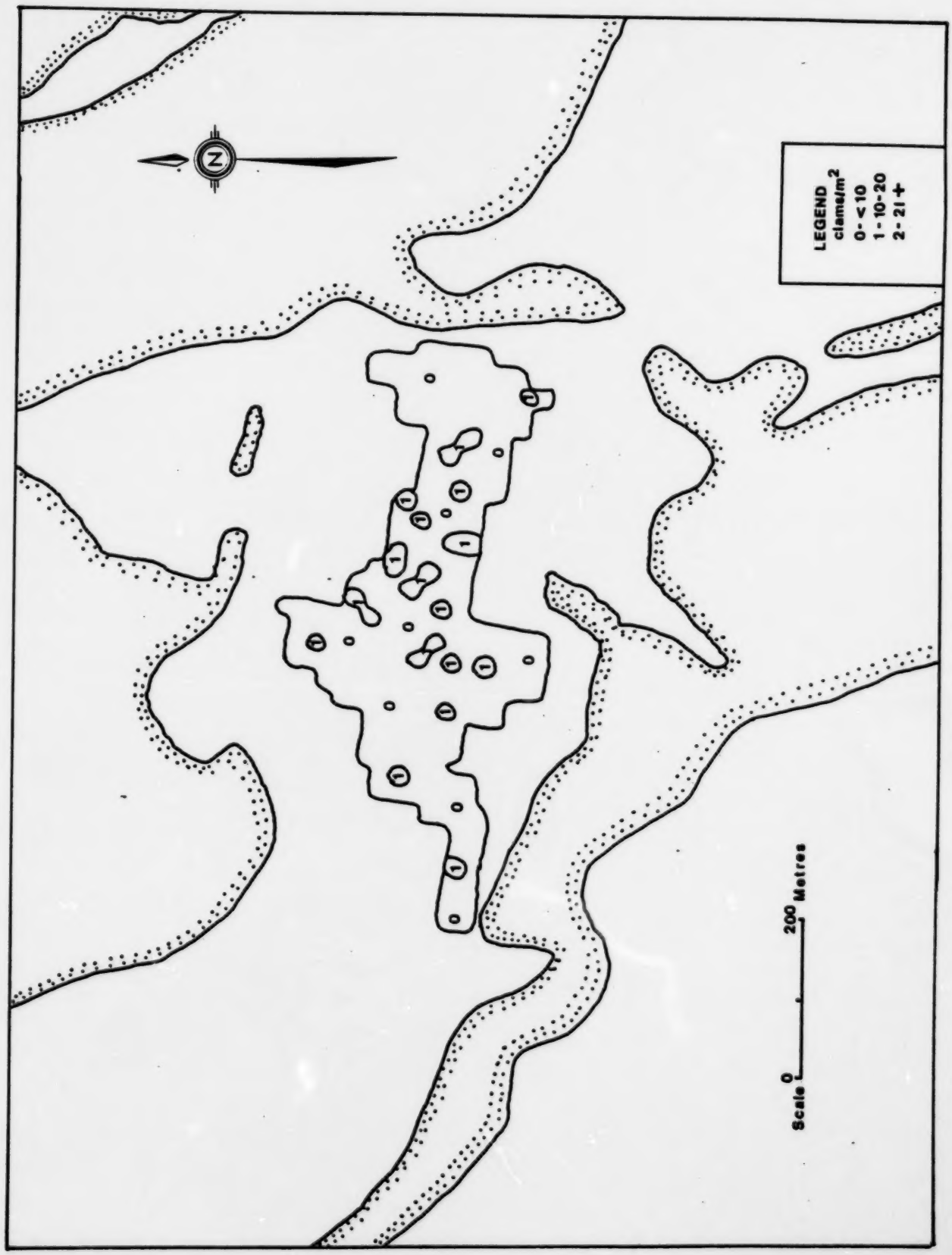

Fig. 5. Three Fathom Harbour - isopleths of clam density and distribution - pre-recruits.

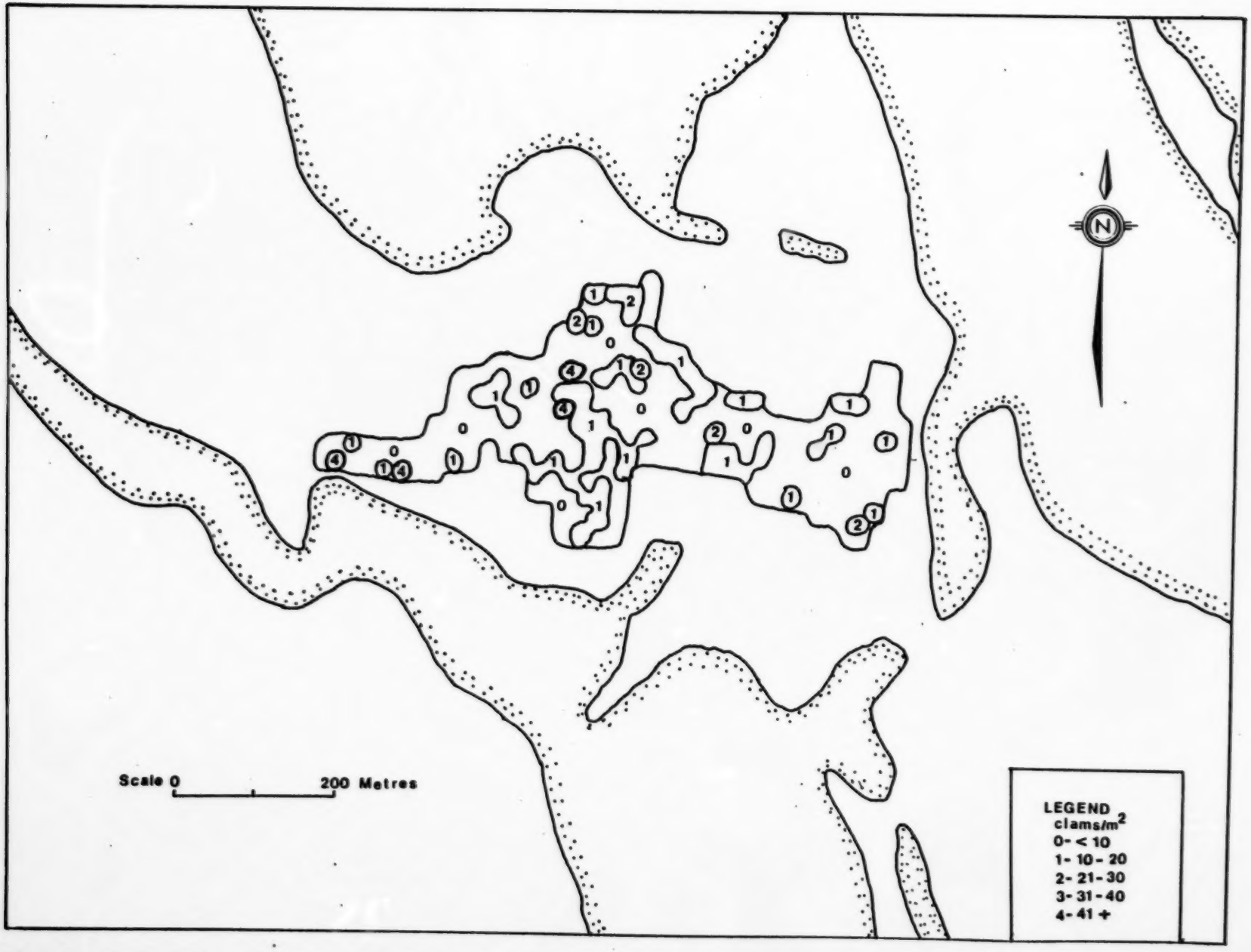

Fig. 6. Three Fathom Harbour - isopleths of clam density and distribution - recruits.

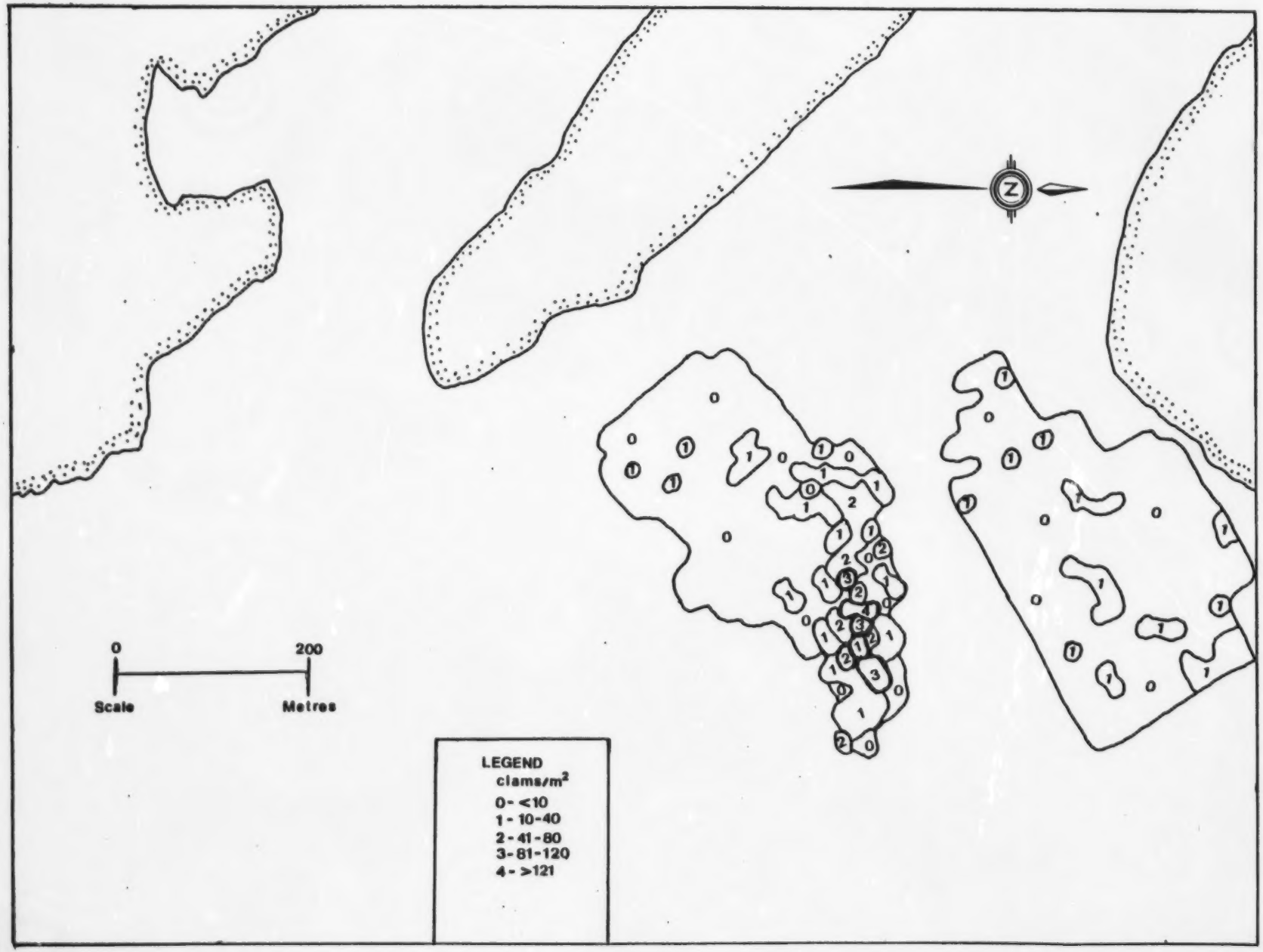

Fig. 8. Clam Harbour - isopleths of clam density and distribution - pre-recruits.

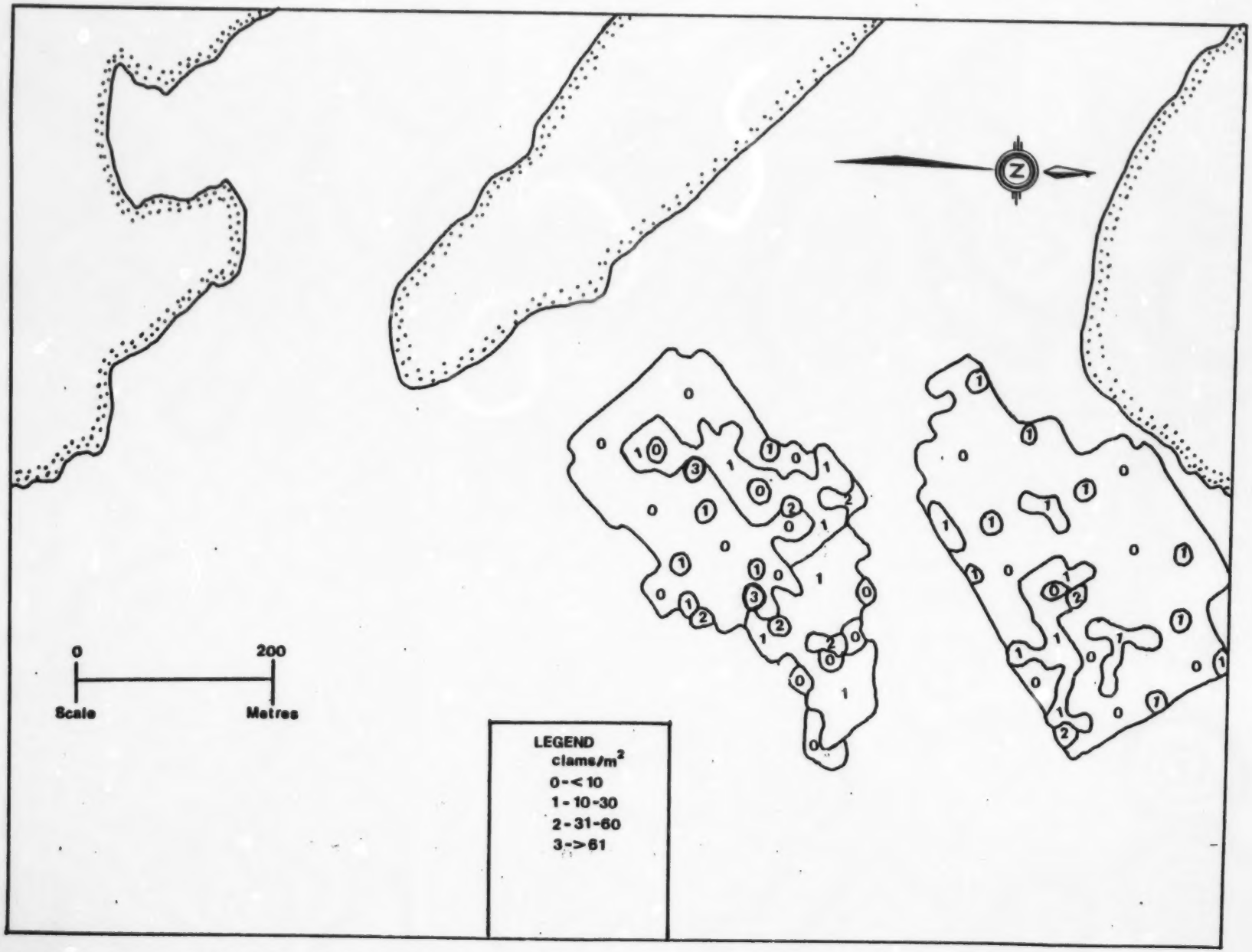

Fig. 9. Clam Harbour - isopleths of clam density and distribution - recruits.

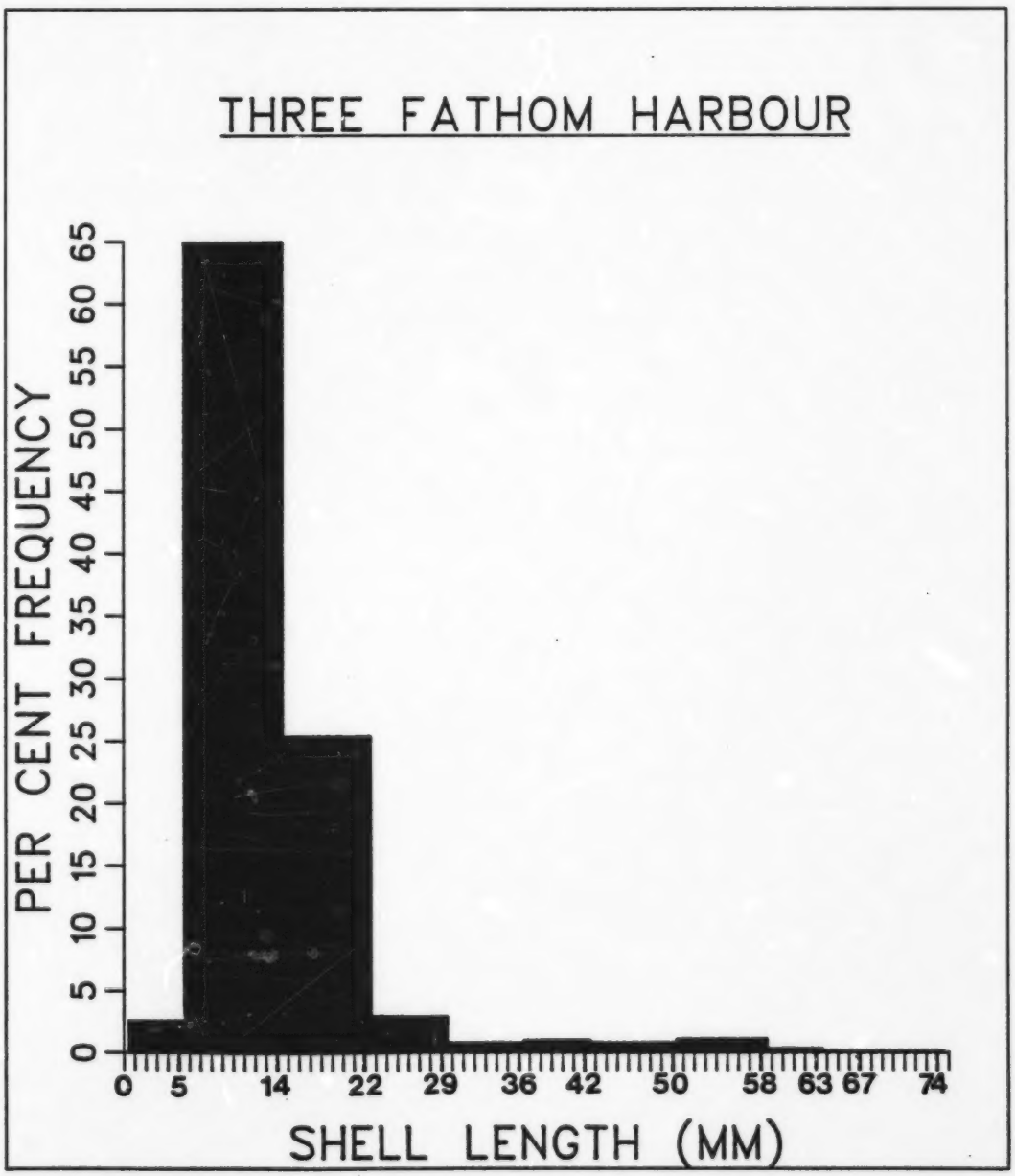

Fig. 10. Three Fathom Harbour size-frequency distribution.

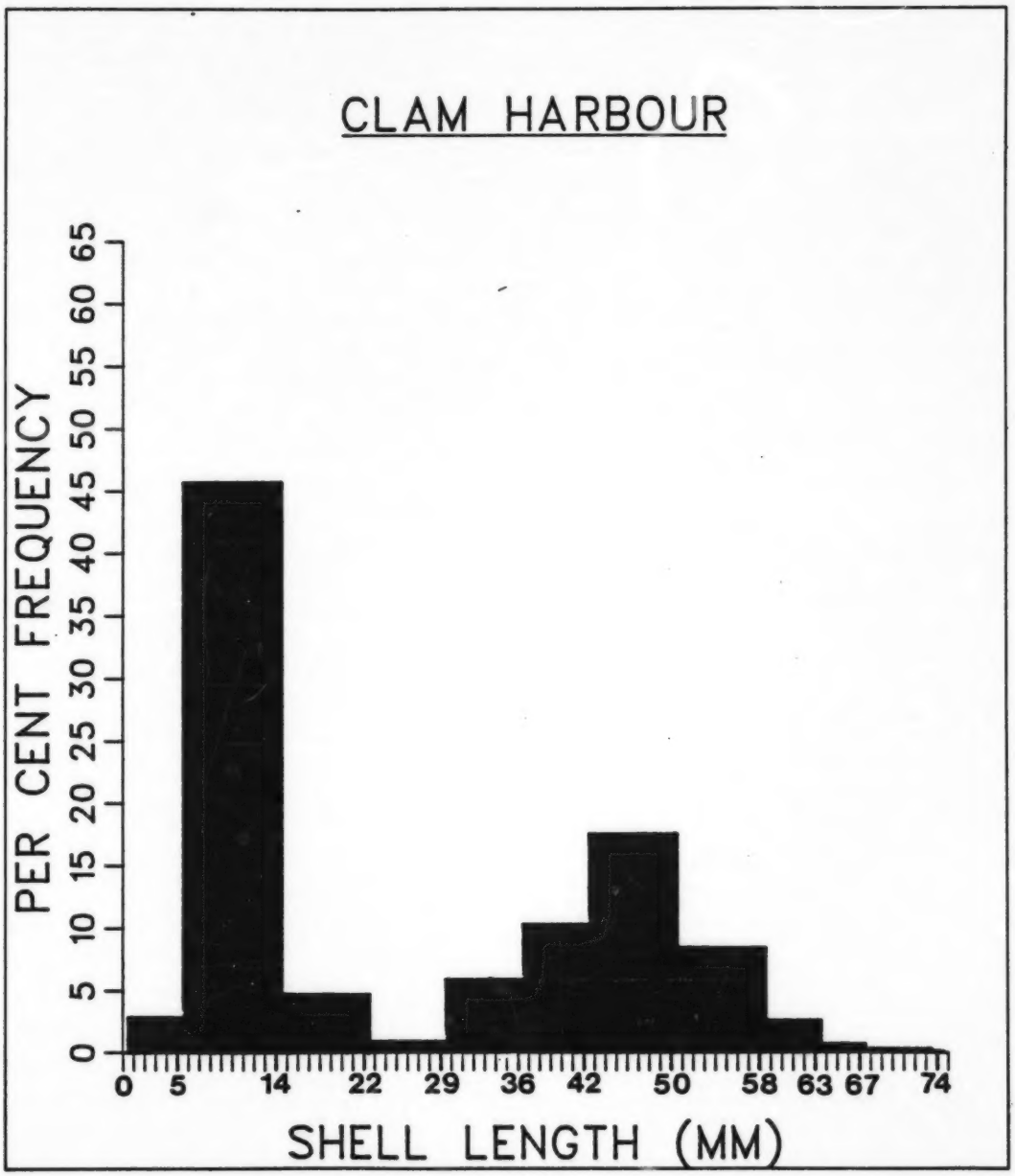

Fig. 11. Clam Harbour size-frequency distribution.